Met Office Space Weather Technical Forecast

-Space Weather Technical Forecast

Issued on Friday, 19 July 2024 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares expected. Chance of G1/Minor Storms late today or more likely tomorrow (19-20 Jul) due to CME arrival

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been moderate with a long duration multi-peaking M-class flare, reaching M2.2 at 18/1014 UTC from AR3751 in the southeast disc. AR3751 remains the most complex region on the disc, classified at Ekc/beta-gamma-delta, and has continued to show some slow growth and development. Currently there are eighteen other sunspot regions on the Earth-facing disc, of which two are unnumbered. The majority of these eighteen regions are small and simple, either stable or with little growth or some decay. The exceptions are AR3743 and AR3759 which have grown in spot number and area, and also AR3753 which is classified as Dac/beta-delta.

No Earth-directed CME's have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by ACE at L1, was at background levels, starting around 360 km/s then gradually decreasing to end the day around 310 km/s. Density remained below average. Interplanetary magnetic field (IMF), Bt, was Weak, ranging 3-6nT with its north-south component (Bz), variable between +4/-3nT, but favouring a positive orientation (northward). Phi angle was positive (away from the Sun) throughout. Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels. The 24-hour fluence was well below Active, with 101e6 integrated pfu observed at 19/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is expected with isolated M-class flares, and a slight chance of X-class flares, given the number of regions on the disc. However, significant flares are most likely from AR3751 in the southeast, and then to a lesser extent from AR3743, AR3753 and AR3759. New or returning regions are also likely to rotate onto the visible disc from the far side through the period and may increase the likelihood of significant flares.

Solar Wind /Geomagnetic Activity: The CMEs from the M1.9 flare at 16/2206 UTC are expected to arrive either late today or more likely tomorrow (19-20 Jul). Any fast wind from CH54/- is most likely to remain north of Earth, but there is a slight chance of weak enhancements today (19 Jul) with solar winds perhaps temporarily reaching slightly elevated levels. Mainly Quiet geomagnetic activity is expected overall, but brief Unsettled periods are possible today (19 Jul) from any fast wind interaction. Then Active to G1/Minor Storm intervals are expected either late today but more likely tomorrow (19-20 Jul) with any CME arrival.

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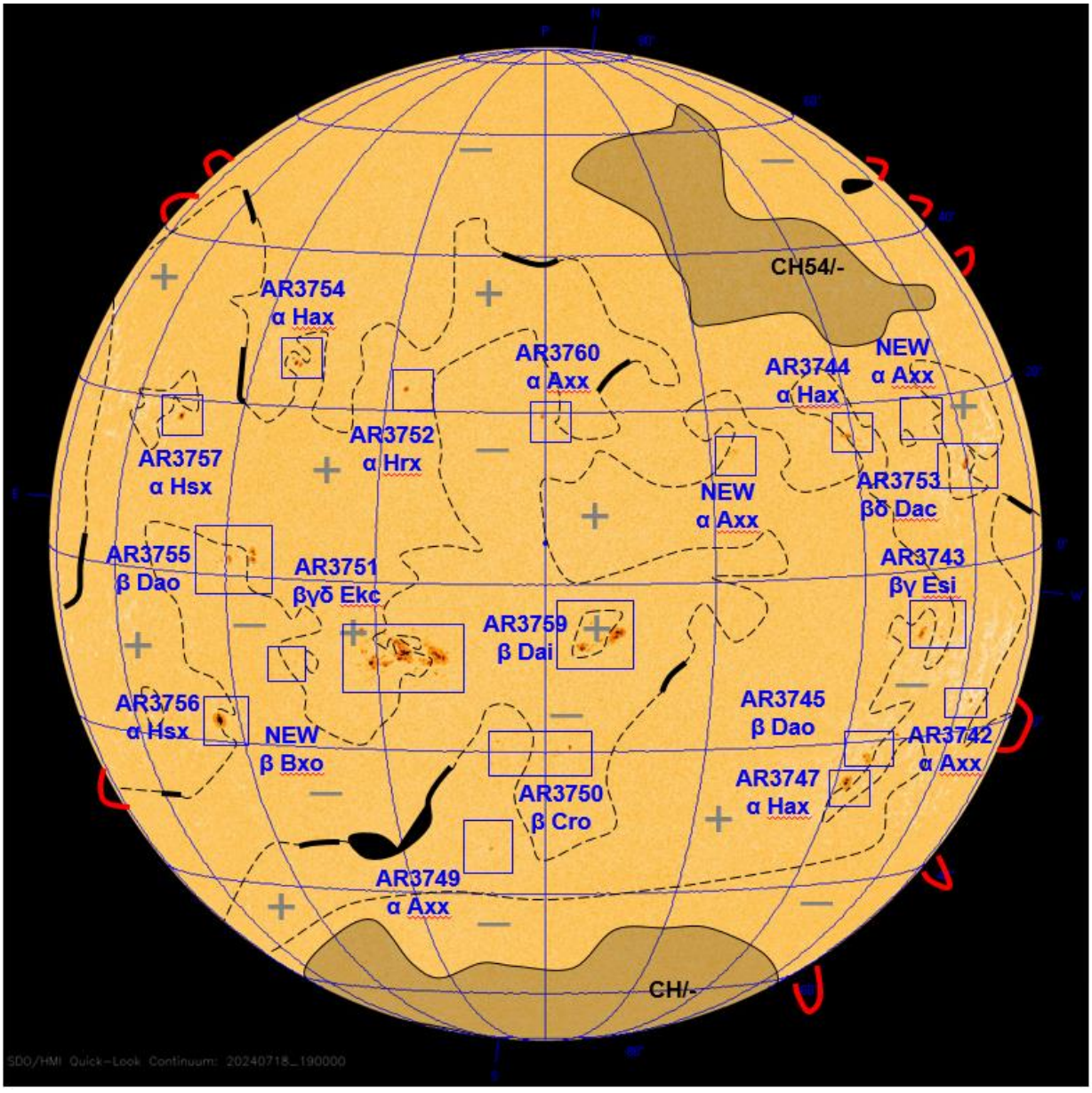
Energetic Particles / Solar Radiation: High energy proton flux is most likely to remain at background levels, but with chance of rising above the S1/Minor Storm threshold in response to any notable flares most likely from AR3751. High energy electron flux is expected to remain at background, perhaps rising to Moderate briefly due to any fast wind connection, but likely suppressed again with any CME arrival. The associated 24 hr fluence is expected to remain well below the Active level.

Figure 1. Solar Analysis Valid 18/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

An M1.6 flare from AR3753 peaking at 16/2123 UTC in the northwest disc, was followed by an M1.9 flare from AR3744 at 16/2206 UTC. A subsequent double CME was observed, although it appears likely these CMEs were both from the second of these flares, with a main material ejecta to the northeast. This was followed with a very weak asymmetric halo CME which is possibly mostly shock, but has not been discounted for some material content. These CMEs are expected to arrive either late today 2 (19 Jul) or more likely tomorrow (20 Jul), although the second and slow of these CMEs may be imperceptible on arrival. However, confidence is low regarding the time of the CME arrivals, due to Enlil currently over-estimating the solar wind speed by approximately 150 km/s. This is because Enlil is indicating that Earth has connected to a fast wind from CH54/-, which is currently incorrect.

There remains a chance of a slight solar wind enhancement occurring from CH54/- today, but the chance is decreasing and the current background solar winds are more likely to persist until the CME arrivals. Therefore Quiet geomagnetic activity is expected to persist until activity increases Active to G1/Minor Storm intervals, most likely tomorrow (20 Jul). Any CME effects gradually decrease days 3 and day 4 (21 and 22 Jul), with mainly Quiet conditions returning.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	60	40	5
Strong	G3	No	1	2	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
17/0334	Nil	M1.9 16/2206 AR3744	N-centre	691 km/s	19/2200 - 6hrs/+12 hrs	Limited shock expected
17/0400	Asymmetric halo	M1.9 16/2206 AR3744	N-centre	530 km/s	20/1000 +/- 10 hours	Limited shock expected

Figure 2: Latest MOSWOC Enlil ensemble forecast.

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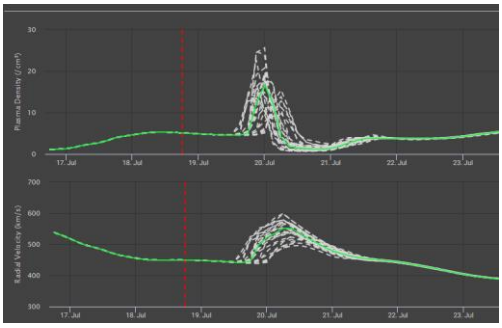
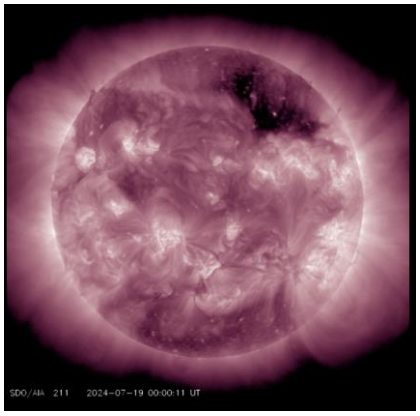


Figure 3: Latest SDO/AIA 211 image showing CH54 in the northern hemisphere.



Radio Blackouts - X-Ray Flares:

Moderate activity is expected with a slight chance of X-class flares.

There are nineteen regions on the disc. AR3751 remains the largest and most complex, with a couple of moderately strong delta spots within its intermediate region and a slow growth trend. The other regions across the disc are generally smaller and simple with many showing only limited growth. The main exceptions are AR3753 and AR3759 which have shown some notable growth in spot number and area, with AR3753 maintaining a small delta spot and AR3759 now classified as Dai/beta.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	70	70	70	70
Very Active	R3 to R5 X Class	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

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High energy proton flux at GOES18 is at background. High energy proton flux is most likely to remain at background levels, but with chance of rising above the S1/Minor Storm threshold in response to any notable flares. Notable flares are most likely from AR3751, and this region will reach the western hemisphere during the forecast period, resulting in a slight increase in probabilities.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	15
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux as observed by GOES-16 is expected to remain at background. Any weak fast wind connection may lead to flux rising to give spells of Moderate today (19 Jul), but this is considered increasingly unlikely. Then any increase in the flux is likely to quickly be suppressed by the expected increase in geomagnetic activity associated with CME arrivals.

The associated electron fluence is expected to persist well below the Active level, with MOSWOC REFM currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model.

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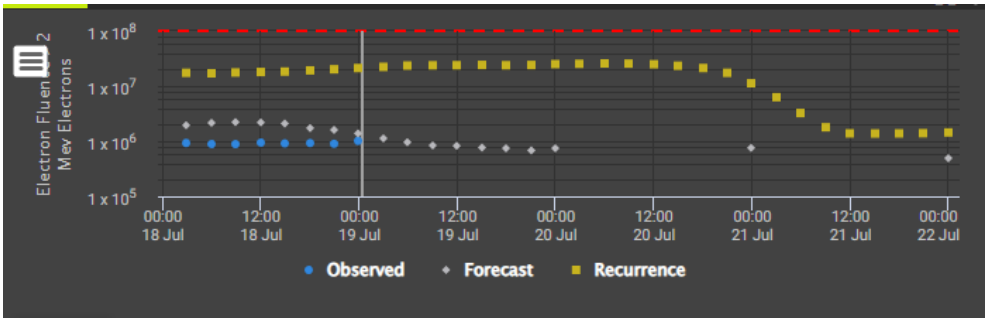

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